Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF IOT BASED SAVING BOX

MUHAMMAD HAZIQ HAZWAN BIN HISHAMUDIN

Bachelor of Electronics Engineering Technology with Honours

2023

APPROVAL

I approve that this Bachelor Degree Project 2 (PSM2) report entitled “DEVELOPMENT OF IOT BASED SAVING BOX” is sufficient for submission.

Signature : 

Supervisor Name : **TS. MOHD RAZALI BIN MOHAMAD SAPIEE**

Date : 27/1/2023

UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FAKULTI TEKNOLOGI KEJUTERAAN ELEKTRIK DAN ELEKTRONIK

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : DEVELOPMENT OF IOT BASED SAVING BOX

Sesi Pengajian: 2022/2023

Saya MUHAMMAD HAZIQ HAZWAN BIN HISHAMUDIN mengaku membenarkan laporan Projek Sarjana Muda ini disimpan di Perpustakaan dengan syarat-syarat kegunaan seperti berikut:

1. Laporan adalah hakmilik Universiti Teknikal Malaysia Melaka.
2. Perpustakaan dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan dibenarkan membuat salinan laporan ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. Sila tandakan (✓):

☐ **SULIT*** (Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)

☐ (Mengandungi maklumat terhad yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)

☑ **TIDAK TERHAD**

(TANDATANGAN PENULIS)

Alamat Tetap: **No 39 Jalan 5/30 Bandar Rinching, Seksyen 5, Semenyih Selangor Darul Ehsan.43500**

Tarikh: **20/01/2023**

Disahkan oleh:

MOHD RAZALI BIN MOHAMAD SAPIEE
Pensyarah
Jabatan Teknologi Kejuruteraan Elektrik
Fakulti Teknologi Kejuruteraan Elektrik Dan Elektronik
Universiti Teknikal Malaysia Melaka

Tarikh: 27/1/2023

*CATATAN: Jika laporan ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali tempoh laporan ini perlu dikelaskan sebagai SULIT atau TERHAD.

DECLARATION

I declare that this project report entitled "DEVELOPMENT OF IOT BASED SAVING BOX" is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : 

Student Name : MUHAMMAD HAZIQ HAZWAN BIN HISHAMUDIN

Date : 20/01/2023

CHAPTER 1APPROVAL

I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electrical Engineering Technology with Honours.

Signature :

Supervisor Name : TS. MOHD RAZALI BIN MOHAMAD SAPIEE

Date : 27/1/2023

Signature :

Co-Supervisor :

Name (if any)

Date :

ABSTRACT

This project is about the development of an Internet of Think (IoT) based saving box. Project upgrades or improvements from standard saving boxes to adding value with the Internet of Think (IoT) system which provides data amount type money either note or coin. Money-type coins need some mechanical setup to counter and also can use sensor weight because each coin has come with a different size and parameter. The same goes for the note type of money, for this alternative way is to use detection through money color. The project needs a microcontroller to control data or signals for the input sensor and output for the project. The system IoT uses the Esp32 Wifi module in this project and the smartphone also collects data for the amount of money. The smartphone is used to monitor and checks the data we collect from the project.

ABSTRAK

Projek ini adalah mengenai pembangunan kotak simpanan berasaskan Internet of Think (IoT). Peningkatan atau penambahbaikan projek daripada kotak simpanan standard kepada menambah nilai dengan sistem Internet of Think (IoT) yang menyediakan wang jenis amaun data sama ada wang kertas atau syiling. Syiling jenis wang memerlukan beberapa persediaan mekanikal untuk melawan dan juga boleh menggunakan berat sensor kerana setiap syiling telah datang dengan saiz dan parameter yang berbeza. Begitu juga dengan jenis wang nota, untuk cara alternatif ini ialah menggunakan pengesanan melalui warna wang. Projek ini memerlukan mikropengawal untuk mengawal data atau isyarat untuk sensor input dan output untuk projek. Sistem IoT menggunakan modul Wifi Esp32 dalam projek ini dan telefon pintar juga mengumpul data untuk jumlah wang. Telefon pintar digunakan untuk memantau dan menyemak data yang kami kumpulkan daripada projek.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 2

INTRODUCTION

2.1 Background

A saving box was invented a long time ago conventional type create to keep coins money or notes but the design of the saving box was not practical when it came to withdrawing money either to use the money or count it because the user need to break the saving box that made from clay later on in past year people tend to invent many types of saving box with different and multi-material like cotton, wood, recycle stuff, steel, etc.

2.2 Problem Statement

The project comes inconvenient to users and needs improvement by applying technology systems like controllers and sensors. Although with a simple upgrading system, we can add value to the project/ saving box for more convenience for the user. The saving box needs optimum size to keep or store money, the type of money to count by sensor, hardware, or mechanism to keep money and counter. Furthermore, adding a display/ LCD to monitor/ show value when the user inserts the money. From the time table user monitor from the smartphone with the IoT system amount of money in the saving box.

2.3 Project Objectives

The main goal of this project is to propose a system saving box with an IoT system for the user's convenience to use the saving box. Specifically, the objectives are as follows:

a) To develop a saving box with the counter type of money coins and notes
b) To monitor the amount of money in the saving box and the amount of money in the smartphone with an IoT system
c) To test the functionality of the prototype in determining the collected money accurately

2.4 Scope of Project

The project comes with limitations even with upgrading with technology so the scope of the project can be defined as follows:

a) Recognize color for note-type money
b) Position style to insert note money for detection by the color sensor
c) Data collected amount money limit to 10 cents, 20 cents, 50 cents, RM20, RM10, RM5, and RM1
d) Malaysia currency money only

CHAPTER 3

LITERATURE REVIEW

3.1 Introduction

The study of earlier projects and the compiling of project-related data were included in the introduction to the literature review. Thus, depending on the technology, system, and equipment, the fundamental principle is used. The development-saving device (current project/proposed project) needs to be connected to the Internet of Things and employ an ESP32 Wi-Fi module as a controller. Following that, this chapter summarises the previous project's workings and offers suggestions for creating an IoT-based storage device using Arduino (current project/proposed project). Additionally, this chapter could provide pertinent data.

Figure 3.1 Internet of Things

3.2 Review of Related Works

3.2.1 Study of RGB Color Classification Using Fuzzy Logic

The system overview used Light-Dependent Resistor (LDR) as a reference to detect the level of light or the presence of light. Three RGB color LEDs were used and objects whose colour required to be detected should be perpendicularly placed in front of the system, hence the light rays reflected from the object that falls on the single LDR [1].

Figure 3.2 Color sensor design

The project focused on RGB layout purpose of this project is to give engineering students an understanding of the technology using process fuzzy logic to solve related to color RGB recognition and their practical problem. The below illustrates a block diagram system were used fuzzy logic to differentiate RGB color.

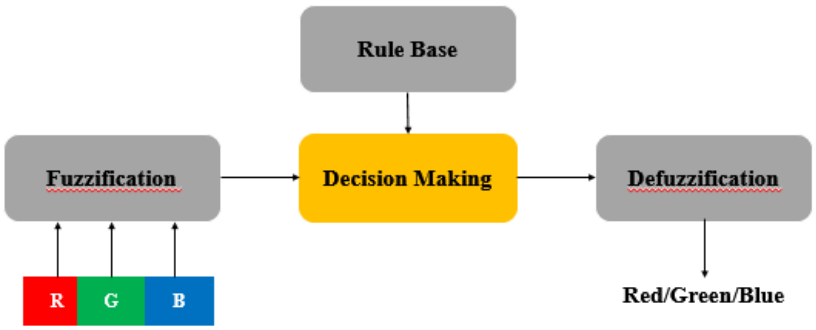

Figure 3.3 Block diagram of the system

Based on Figure 2.3 fuzzification is the method of mapping clear inputs to fuzzy membership functions. The fuzzification is necessary because the distinction was made not only in the membership of the variable but also in its relative degree [2]. Three sets of membership values are defined for the sensor inputs for the red color, green color, and blue color also key for detection based on color low, medium, and high. Figure 2.4 below shows the fuzzification membership function.

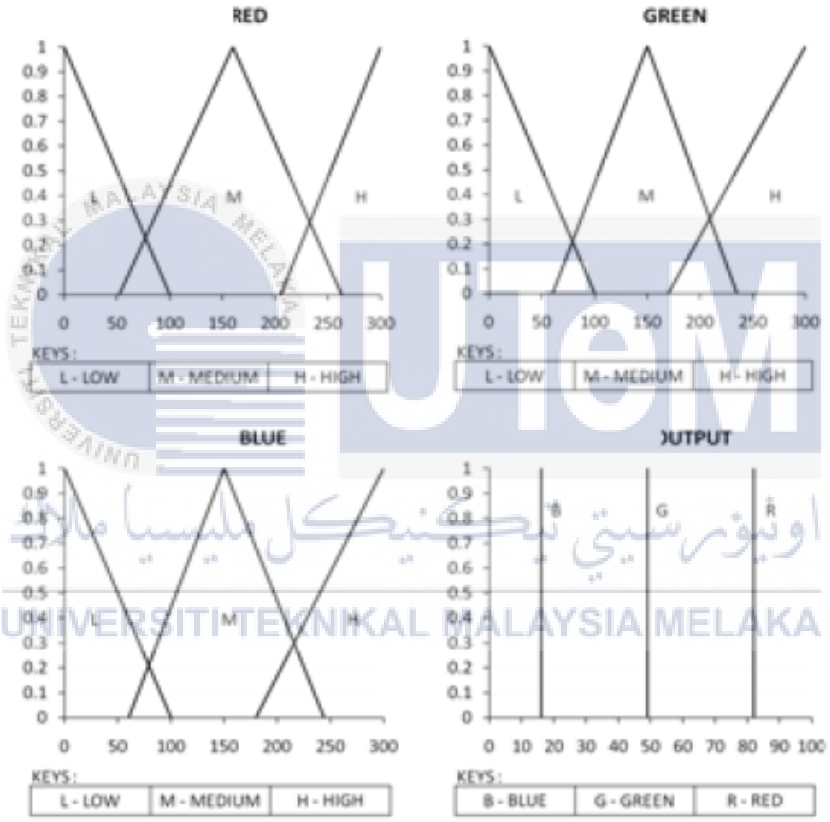

Figure 3.4 RGB color input membership function

Defuzzification calculation of the crisp output is where the output is generated based on the input. Referring to Figure 2.4 in this system, they used Sugeno inference. Then, Fuzzification parameters are adjusted so that the sensor data are captured in the set of values contained in the fuzzy input variables. The rules are adjusted and modified so that fuzzy output variables properly described what should be the result.

3.2.2 Machine Vision-Based Coin Separator and Counter

The project was made in India country, aspect of religion there are more numbers in the temple where more people tend to make a lot of people donate and required places or storage to keep the coins/money, so they need more donation boxes. The manual method of counting the coins does not have any recording device for future usage. This is not only happening in temples but also in banks which deal with more coins and currency every day [3].

The proposed system use methodology in this model is an embedded system with a LabVIEW controller used to control the whole system. The concept of the project is to utilize the digital image-processed template-matched algorithm by which the value of the coin is identified. In a beginning, LabVIEW (Laboratory Virtual Instrument Engineering Workbench) is a graphical programming language that uses icons instead of lines of text to create applications [4]. In contrast to text-based programming languages, where instructions determined the order of the program executed, LabVIEW uses dataflow programming, where the flow of data through the nodes on the block diagram determined the execution order of the VIs and functions. VIs, or virtual instruments, are LabVIEW programs that imitate physical instruments. Figure 2.5 one of the sample UI made using LabVIEW.

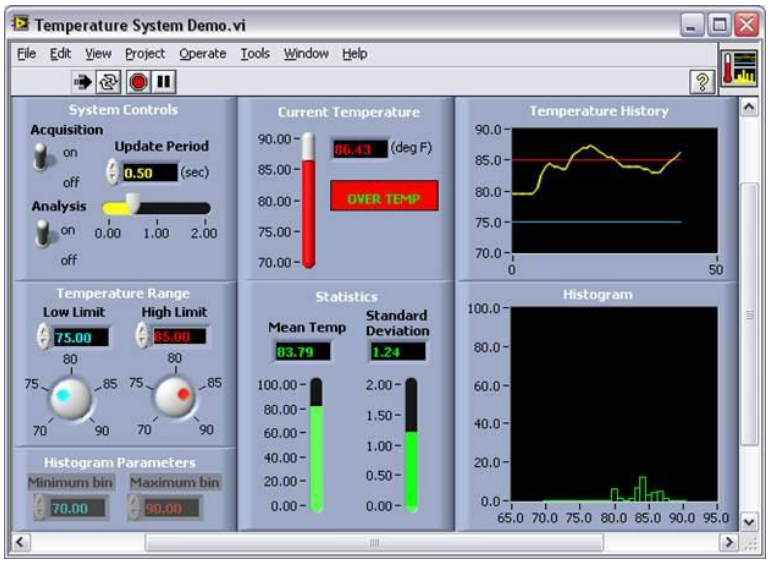

Figure 3.5 Sample LabVIEW UI

The digital camera was used in the project to act as the eye of the module, by enabling LabVIEW software and the hardware to acquire the image of the coins. Next, Figure 2.6 show a sample digital camera that can use with LabVIEW for image processing

Figure 3.6 Sample digital camera

The next component NI myRIO-1900 is a portable reconfigurable I/O (RIO) device that students can use to design control, robotics, and mechatronics systems. The component provides analog input (AI), analog output (AO), and digital input and output (DIO) [5]. Figure 2.7 show a sample NI myRIO-1900.

Figure 3.7 Sample myRIO-1900

An IR sensor is an electronic device that emits light to detect/sense some object in the surrounding also the sensor can measure the heat of an object as detected the motion. An IR sensor is a discrete type of sensor. The sensor sends a logic high 5V signal at its output. It is used to detect the presence of coins and to count it. Figure 2.8 below is the IR sensor

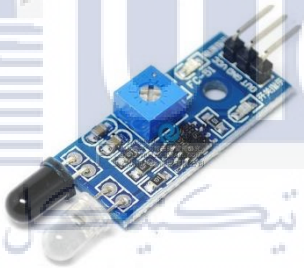

Figure 3.8 IR sensor

This project used a servo motor which the capability to stop at a precise angle It has high starting and stall torque. It is used to tilt the edge plate of the conveyor to five pre-set positions to make the coin fall at respective boxes. The Servo motor sample has been shown below in Figure 2.9

Figure 3.9 Servo motor

The project working, coin separator is commonly used nowadays like a vending machine or laundry machine for converting money to coin but in this case separator coin for the donation box at the temple. The project needs to specify dimension coins that use in India like 1 rupee with a dimension of 22mm, 2 rupees with a dimension of 23mm, 5 rupees with a dimension of 25mm, and 10 rupees with a dimension of 25mm. The identified coin is made to fall into the four containers (for 1, 2, 5, and 10 INR) as shown in Figure 3 [3]. It is made with the aid of a servo motor, which turns the conveyor to the required angle. There are sensors attached to the end terminal of the conveyor to count the coins in each part. The counted coins are displayed on an LCD, by which the value can be acquired.

Figure 3.10 Setup mechanism for project coin separator and counter

The project needs to choose the template and train the template after first taking for the software to realize the coins and the increment values. There is a fifth box, placed inside the setup, which is used in case of a forgery or invalid coin [3]. If any such coins are detected, it is collected in the box and mentioned on the display. Figure 2.11 below shows a sample of one of the coins training.

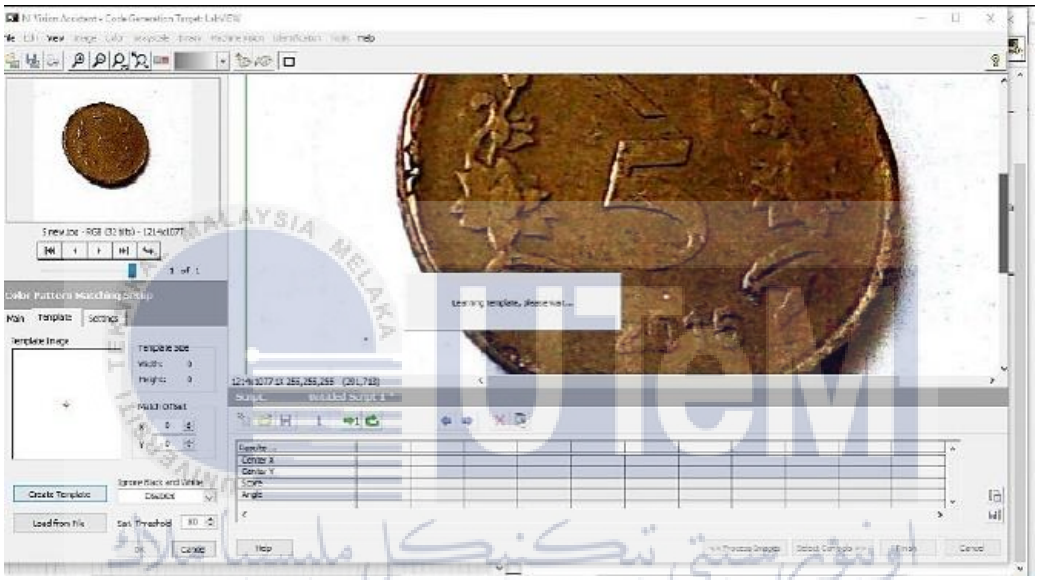

Figure 3.11 Template training for 5 rupees coin

3.2.3 Internet of Things (IoT): Charity Automation

The project background was in the eastern country of Saudi Arabia people want to help and donate to needy people. Furthermore, refer background project in that place currently has several applications in the donation process of the Saudi Food Banks “Eta’am”, “Makkah charity”, “NemahKeep”, and “Alber Charity” Then, in this project not all limitations for each food bank are included in this chapter because the main focus related to our proposed project.

The limitation of the Eta’am charity organization system only accepts food donations from big ceremonies minimum invited are 70 guests, and the donator cannot create an account each time they have to fulfills a form repeatedly and send it to the charity, and they have no interaction between the donors and the charity, needy people cannot easily register themself to receive donations, and registered needy people by the charity cannot update their location automatically in case if their location is changed [6]. The Alber charity organization & Dar_Alkhair charity organization are the biggest charity organization in Saudi Arabia that collect money from the government, companies, rich people, and donators the limitation of that organizations are they do not use technology inefficient way, Donators have to visit the charity organization to donate physical donation like Clothes‟, the charity ignores the donation boxes for a long time, the cost of checking the donation boxes is high and makes a lot of effort to the charity employee, there is no mechanism to check the status of donation boxes and needy people cannot set a priority of their need.

Those limitation projects were improved by Maher Omar Alshammari, Abdulmohsen A. Almulhem, and Noor Zaman in February 2017. The project consists of an application system

that is a combination of an Android smartphone and a website in which the donors use navigate function to get precise and detailed location coordinates. The donation box is called the Smart Donation Box (SDB) able to communicate with a charity to make sure donations are not wasted with this project [3]. Figure 2.12 shows Arduino starts with a connection with charity server donation. Then, the sensor scan and deduct the object inside the donation box to reach a certain level so Arduino can be noticed by the charity.

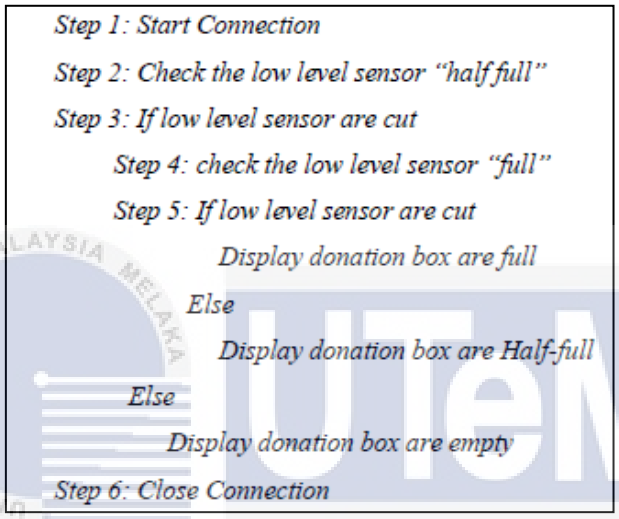

Figure 3.12 Smart Donation Box (SDB) algorithm

To connect to the server of the non-profit organizations, the researcher utilized an Arduino Wi-Fi shield. The information requested by the donor or those in need must be filled in, and they must register using the Android app's registered notification message, which they can access by referring to Figure 2.13.